Department for Transport

Infrastructure and Projects Authority

Lessons from transport for the sponsorship of major projects

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Foreword

Transport infrastructure plays a key part in our lives, in the economy, and in the connectivity and quality of the places in which we live. Building and improving our transport infrastructure requires the successful delivery of some of the biggest and most complex projects in the UK, and indeed the world. The Department for Transport plays a central role in the oversight and delivery of these projects, and I am proud of the work we and our delivery partners do.

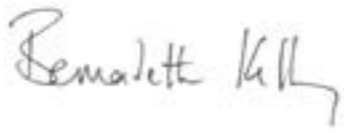
However, we do need to address the significant challenges we have seen in the delivery of some of our major projects, including most recently on Crossrail. It is vital that we are constantly challenging ourselves to learn from experience when things go right, and perhaps even more importantly, when things go wrong.

That's why I commissioned this report jointly with the IPA. I am determined that we should capture, learn and share lessons about how we can strengthen our oversight and delivery of major projects.

This report identifies 24 practical, best-practice lessons across five key themes – accountability, behaviours, control of schedule, costs and benefits, systems integration, and entry into service – which will help to raise the bar on how we deliver projects in government. Many of these lessons are already a part of our project delivery but in the months ahead I look forward to working with our delivery partners to embed them fully across my Department's portfolio.

For me, two points emerge from this work above all. The first is that successful delivery of projects is as much about the interaction of human behaviours – in particular around accountability, trust and transparency – as it is about processes. The second is that major projects of this scale and complexity are inherently difficult so we must constantly challenge ourselves to strive for excellence if we are to deliver for users and taxpayers.

My thanks to the DfT and IPA team who led this work and to the many project leaders who contributed their wisdom and experience.



Bernadette Kelly
Permanent Secretary, Department for Transport

When it comes to delivering infrastructure, we are living through a critical time. It has never been more important to ensure we are learning the right lessons from projects that have gone before. It is our ambition, as government's centre of expertise for infrastructure and major project delivery, to create the best performing project system of any government in the world. To do this, we must identify the right lessons, and also apply them to future projects and improve the system for the longer term.

The value of this report is in the quality, practical and applied nature of the lessons we have identified. They are distilled from the real-life experience of our project leaders and are designed to improve our collective project delivery practice.

Some of the lessons are more directly applicable to rail and other infrastructure, but most of them are relevant across the whole range of the government's £450 billion major project portfolio. The IPA will incorporate this work into our body of knowledge, training, standards and advice, as well as our independent assurance.

As I have been discussing the messages behind this report with project leaders, in both the public and private sector, I have been struck by how much it resonates with people. Whether it's focusing on behaviours and culture over process, or the need to address systems integration, we are all in agreement that these are the critical areas where we need to concentrate our attention in order to improve delivery confidence across our most challenging and ambitious projects.

Matthew Vickerstaff
Chief Executive, Infrastructure and Projects Authority

1. Introduction

Purpose

1.1 Controlled delivery of the Government's major projects is fundamental to realising their intended benefits, allowing investment decisions to be taken confident in the likely range of outturn costs and deadlines, and delivering the new capabilities into service in a way which protects current users.

1.2 This report identifies lessons and good practice for the sponsorship of major projects from the significant issues experienced with the Northern and Thameslink projects (constituting part of the overall May 2018 rail timetabling changes) and with Crossrail. It aims to balance honest and objective consideration about what has not worked with recognition that the challenges of delivering major projects are significant, that much is done well, and that rarely do issues arise due to people's poor intentions.

1.3 The delivery of the Crossrail, Northern and Thameslink projects experienced issues which meant they have not been delivered to their intended plans or in a way that avoided detriment to current and future passengers. This is despite their extensive governance, reporting and assurance arrangements across the supply chain, delivery organisations, and sponsors. It is the case that many of the anticipated benefits of these projects have now been delivered, or will ultimately be secured, and in many areas the projects embodied important good practice. It is nevertheless crucial to reflect on the significant issues that arose, to understand their nature, and to share the positive and negative lessons to improve controlled delivery of major projects by government departments.

1.4 These lessons are most directly applicable to other infrastructure projects delivered through arm's length bodies sponsored by central government departments, but are intended to inform wider government projects including defence systems and major ICT projects. They could similarly be applied to large projects delivered elsewhere. The Department for Transport and its delivery organisations are responding to these lessons in terms of the structures, procedures and behaviours adopted in establishing, overseeing and delivering major projects. Similarly, the IPA is embedding these insights into its guidance and assurance work across other government departments.

Structure of the report

1.5 The report has three parts:

- **Section 1** sets out the context for major project delivery in government and identifies five themes that encompass the lessons identified.
- **Section 2** contains a schematic of the 24 lessons identified, structured by project lifecycle stage, governance pillar, and by the five themes. Each lesson is accompanied by a more detailed explanation.
- The **Appendices** include a brief description of the case study projects (**Appendix A**), a list of interviewees (**Appendix B**), definition of terms used in the report (**Appendix C**), and references summarising the written sources drawn upon (**Appendix D**).

Scope and approach

1.6 This review was conducted by a joint team from the Infrastructure and Projects Authority and the Department for Transport (DfT) based on a review of diagnostic reports into project issues and interviews with project leaders from the Department for Transport and its delivery organisations.

1.7 Alongside the two projects that suffered issues in May 2018 timetabling and Crossrail, this report has also reviewed the Great Western Electrification Project and the Highways England Complex Infrastructure Programme as well as other reports on transport issues including by Dame Bowe and Sam Laidlaw.

1.8 Where relevant the review team has drawn on its experience of good practice and challenges in other major projects including the Environment Agency Flood Protection Programme, High Speed 2, Thames Tideway Tunnel and the Palace of Westminster Restoration and Renewal Programme.

Context

1.9 Delivering major projects successfully is intrinsically difficult. Major government projects are often large scale, technically and operationally complex, and attempt to do things that have not been done before to support improved public services that would not otherwise be delivered. They have both to win and sustain public support in a potentially divisive political and media culture that can sensationalise both real and perceived failures. Major projects are often asked to deliver against aggressive timescales set early in their lifecycle. They are expected to deliver to schedule and budget and, as they employ public money, to be right first time – resulting in both informed and uninformed criticism when this does not happen, even if the subsequent capabilities are widely valued and ultimately realise the intended benefits.

1.10 There are nevertheless good reasons why our systems of approval, scrutiny and control demand delivery against long-range predictions of costs, timescales and benefits so that governments can choose reliably to invest in one project as opposed

to another when allocating taxpayer funds. It is therefore right to seek to identify and share lessons from what went wrong, and what also went well, to increase confidence that future transport, infrastructure and wider government projects are delivered with confidence, predictability and control.

1.11 Major government infrastructure projects in the UK are most commonly started, approved, funded and overseen by a sponsoring Department of State (or Departments). They are normally delivered through arms-length bodies (ALBs) of a range of forms (collectively termed "delivery organisations" in this report) and most commonly via executive agencies or public corporations. It is the delivery organisation's job to take the requirements of the sponsor, turn them into specifications, contract for their delivery and secure the intended outcomes to time, quality and cost through their private sector supply chain. These delivery organisations are normally owned and funded by the sponsoring Department and may be a 'Single Purpose ALB' set up for a single project (for example Crossrail and HS2 Ltd), or an enduring organisation overseeing a portfolio of activities, some of which may be major projects (for example Network Rail and Highways England). Some major projects are delivered internally directly by Departments and in these cases the organisational dynamics and governance tend to be more straightforward, but issues can still arise in relation to project delivery.

1.12 This separation of functions allows Departments to specialise in government policy and legislation whilst the delivery organisation focuses on project delivery through its contracted supply chain and advisors. This division has significant advantages but can also create boundary issues and sometimes cultural challenges between the organisations. Successful delivery in this context requires effective performance by the sponsor Department, its delivery organisation and the supply chain. It also requires effective governance between these organisations to establish a common purpose, sufficient joint capability and to maintain control of the project.

1.13 Different sorts of issues can arise through the project lifecycle. The design stage is of particular importance as it establishes the pre-conditions for successful delivery and a poorly initiated project may not be recoverable. Departments should understand the scale and complexity of the projects they seek to deliver, as well as their existing portfolio and overall capacity, and consider delivery arrangements accordingly. If Departments rush mobilisation and fail to establish the right culture, clear accountabilities, appropriate resources, a realistic budget and achievable timescales, then it can be very challenging to deliver a major project successfully however great the subsequent motivations and efforts.

1.14 Successful set up is however no guarantee of successful delivery subsequently. Future challenges and stage transitions need to be anticipated by overcoming the inertia preventing evolution of governance structures, plans behaviours and capabilities.

1.15 The remainder of this report identifies lessons sponsor Departments in overseeing the successful delivery of major projects by their delivery organisations in this context.

Five themes encompass the 24 lessons identified

(A) Accountability must be unambiguous

Separating policy from delivery allows organisational specialisation but creates boundaries and the scope for blurred accountabilities. Departments need to establish clear accountabilities for both individuals and organisations, and must hold the Boards of their delivery organisations to account for ensuring major project delivery to time and cost. In turn Departments need to set clear sponsor requirements, provide a stable operating environment, the space to permit delivery without losing oversight, and to support delivery organisations in navigating interdepartmental policies and approvals.

- **Ensure clarity of role and the extent of autonomy**
  Failure to assign project roles precisely and explicitly within and between organisations leads to conflicts, gaps, duplication and poor project outcomes. Departments need to strike the right balance between retaining overall control and enabling autonomous delivery. This depends on the project stage, the delivery organisation's capability, and risk appetite. Sponsors should beware the false comfort of close control and should instead allow the delivery organisation earned autonomy to do its job but without relinquishing oversight and challenge.
- **Hold the delivery organisation's Board accountable for controlled delivery**
  The delivery organisation's Board is accountable for ensuring the delivery of its major projects, with secondary oversight by the sponsor. Departments should ensure that the duty of the delivery organisation's Board to challenge the executive's management of the strategic risks is as clear as its duty to oversee corporate duties. Board appointees need to understand this additional role. The skill and composition of the Board should evolve to reflect the project stage and to maintain critical distance and fresh perspectives.
- **Evolve governance and personnel across the lifecycle stages**
  The nature of sponsorship should evolve over the project lifecycle and failure to do so can mean previously successful approaches fail in the next stage. The extent of Departmental direction, oversight and support for delivery organisations should evolve with more direct involvement during the design stage before moving to an oversight role to give the delivery organisation space to deliver the construction stage. The sponsor should ensure that the delivery organisation achieves a marked transition from the build to commissioning stage and that the delivery organisation provides for adequate testing and a safe entry into service.
- **Maintain a stable scope and operating environment**
  Sponsors must assess the deliverability of major projects in relation to both scale and complexity at the design stage and be realistic as to what is achievable. They must then establish and maintain a clear set of sponsor requirements and a stable operating environment for the delivery organisation. This includes providing sufficient resources, avoiding scope changes, and not stepping in on delegated decisions unless the delivery organisation is persistently failing.

- **Joint sponsorship requires careful design and operation**
  Sponsors need to set up joint governance with care to address the increased complexity. They must also ensure that they each act in line with their own accountability to oversee the project rather than relying on the other sponsor. Well-developed relationships are needed to maintain effective joint-working when issues arise.
- **Join up across Departments**
  Departments should support the delivery organisation in navigating integrated approvals plans, financial controls, and in aligning policies and dependencies to enable delivery of wider benefits.

(B) Behaviour matters more than process

There are common traits that can lead to the wrong behaviours and decisions on major projects. These are not easily countered even with clear accountabilities and structural checks and balances. They need to be searched for, recognised when they exhibit, and actively countered through calm and objective assessment of the evidence and by instilling the right behaviours within and between organisations.

- **Act decisively when in exception**
  If the considered evidence identifies delay or cost escalation sponsors need to act decisively, despite the presentational consequences, rather than hoping the situation can be recovered later.
- **Invest in building relationships between leaders**
  Resilient and mature relationships between the project leaders in the Department, delivery organisation and its principal suppliers are needed to avoid blame and misperceptions, divergent assessments of issues, and to agree jointly on the best route to recovery when challenges arise.
- **Use control gates to step back and consider status objectively**
  Progress and projections need to be considered dispassionately against criteria that are determined in advance. Leaders should avoid the tendency to find a way past inconvenient realities which can store up problems for later.
- **Challenge the objectivity of delivery confidence assessments**
  Traits encourage leaders to interpret progress reporting as absolute fact, to view them too positively, and to asses them without healthy scepticism. Leaders should actively seek multiple views on delivery confidence, reward rather than deter the escalation of issues, and know how to test reported progress against the realities on the ground.
- **Recognise both the value and limitations of independent assurance**
  Internal and external assurance should be targeted on the decisions taken to manage schedule, cost and benefits. Scrutineers should avoid taking uncritical comfort from the mere conduct of assurance and from assurance findings that may be imprecise or carefully caveated.

- **Invest in preparing contingency plans for the most significant risks**
  It takes discipline to divert resources to develop mature plans to deal with and rehearse the most challenging circumstances. However, they can reduce the likelihood of problems arising and allow better decision making if they do occur.
- **Identify, capture, share and apply lessons**
  Leaders should invest in reviewing the lessons from good and bad experience elsewhere and capture and share their own lessons to the benefit of other project leaders.

(C) Control schedule and benefits as well as cost

A major project's success is measured against its delivery of the agreed scope and benefits within the budget and schedule. Most projects focus on cost at the expense of the other success factors rather than protecting benefits and schedule. Projects fail to manage cost and time to target as the targets themselves are often locked-in too early and before there is sufficient evidence to gauge their feasibility.

- **Use an evidenced range rather than a single target date**
  In-service dates are routinely missed because they are set without rigorous planning or evidence including reference class data and schedule contingency. In-service dates are often set politically in advance of formal advice or sufficient evidence. Premature commitments to definitive in-service dates should be avoided, and ranges used instead until uncertainty is reduced.
- **Set a realistic cost envelope**
  Cost forecasts continue to be exceeded too often despite optimism bias adjustments and contingency being applied. This is often because scope and specifications are not sufficiently developed or included at the point the cost envelope and contingency is approved. Better use of reference class forecasting should be used at the design stage to test estimates against historic evidence. Projects should develop plans at the start of the project to identify options that sustain sufficient benefits but realistically reduce costs in the event that affordability challenges emerge.
- **Protect benefits**
  Foster a culture of benefits-led decision making within major projects continuously and especially when changing scope or requirements. Work across Departmental boundaries to ensure that wider benefits beyond the direct control of the delivery organisation are realised.
- **Test value for money through benchmarking**
  Despite the extent of its buying power, central government does not uniformly and systematically collect, analyse, and share benchmarking data to test value for money or conduct should-cost modelling. Government should accelerate the work underway to build this capability and ensure that data is shared between its projects.

- **Increase focus on managing schedule**
  Delays increase costs and normally lose or defer benefits. Money can be wasted seeking to accelerate towards unachievable dates, and when despite this, delays occur they impact both end-users and other projects. Start from the presumption that delays cannot be recovered.

(D) Deal with systems integration risk

ICT and defence systems projects put more emphasis on managing systems integration risk than infrastructure projects despite the latter's increasing technical and complexities. System integration failures typically present late in the project lifecycle but sponsors need to establish the conditions for success at the start of the project. These include limiting complexity, ensuring clear accountability for managing systems integration with a capable and empowered organisation, ensuring that work is packaged in a way that reduces interfaces between suppliers, and by diligently protecting the duration of test phases.

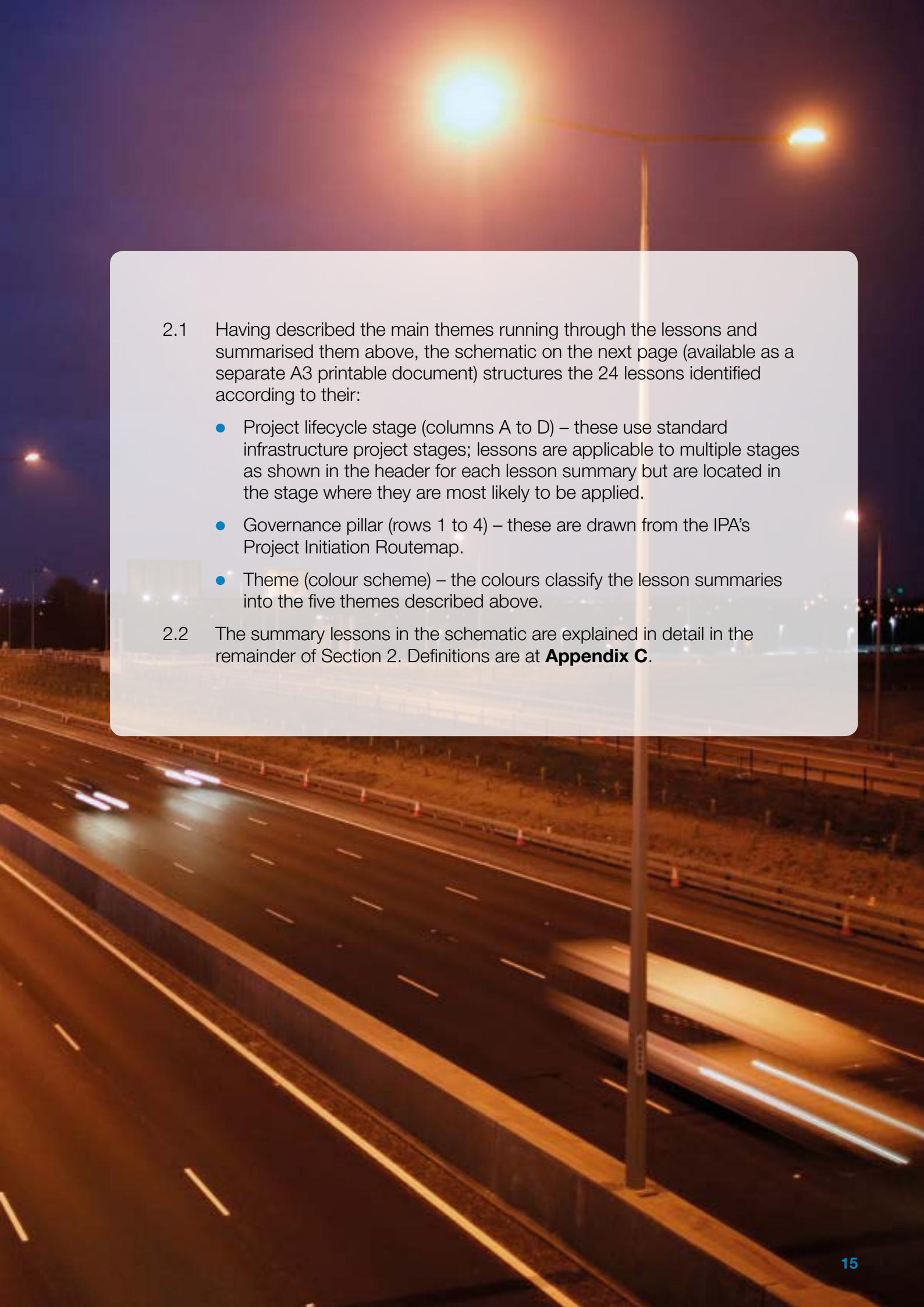
- **Ensure clear organisational accountability for systems integration**
  Sponsors should ensure that the delivery organisation has established a single organisation with clear accountability for managing systems integration, that it has sufficient capability and capacity in relation to the complexity of the challenge, and that it is empowered to direct suppliers in relation to integration decisions.
- **Reduce systems integration risk by controlling complexity**
  Sponsors need sufficient capability to understand the nature of integration risks. Do not view complexity as a free good and take engineering advice at the design stage on the scale of integration risk being generated by the requirements being contemplated. Ensure that the delivery organisation is letting contracts in a way that reduces integration risk between each package.
- **Protect the test phase diligently**
  Test phases need to be protected from compression if early project stages run late against the target in-service date. Consider test strategies and commission approaches that allow progressive de-risking of integration risks.

(E) Enter service cautiously

Poorly planned and controlled delivery into service of new capabilities can impact the existing services and users the major project is designed to benefit. Organisations delivering projects where there are many interdependent systems need to manage the resources, constraints, dependencies and impacts of the whole portfolio of multiple major projects through an informed and empowered portfolio function. Without this they risk impacts on the supply chain, consequential delays on other major projects, and unanticipated combined impacts on the existing service and its users.

- **Ensure clear accountability for the decision on whether to commission**
  Departments should ensure that there is clear accountability for deciding whether to commission into service or not, that the responsible organisation establishes robust consultation procedures with all interested parties, that the point of no-return is understood by all, and that there are safe recovery procedures to sustain the existing service if a decision not to commission is taken.
- **Manage the whole portfolio to protect other projects and service users**
  Departments must ensure that portfolio functions are properly resourced, informed and empowered at the delivery organisation and corporate level. Departments need to understand the aggregate level of risk on the existing system and to manage the dependencies between their major projects. Major projects may need to be asked to compromise their own schedule to protect existing operations and other major projects.
- **Prepare to recover from disruption when new services are introduced**
  Residual risk remains however good the preparation for entry-into-service. Departments should ensure that contingency plans are in place and exercised so any impact on existing services can be contained and recovered.

2. Lessons identified



2.1 Having described the main themes running through the lessons and summarised them above, the schematic on the next page (available as a separate A3 printable document) structures the 24 lessons identified according to their:

- Project lifecycle stage (columns A to D) – these use standard infrastructure project stages; lessons are applicable to multiple stages as shown in the header for each lesson summary but are located in the stage where they are most likely to be applied.
- Governance pillar (rows 1 to 4) – these are drawn from the IPA's Project Initiation Routemap.
- Theme (colour scheme) – the colours classify the lesson summaries into the five themes described above.

2.2 The summary lessons in the schematic are explained in detail in the remainder of Section 2. Definitions are at **Appendix C**.

LESSONS FOR THE SPONSORSHIP OF MAJOR PROJECTS

Governance pillars

Project lifecycle stages

	Design stage (A)	Construction stage (B)	Commissioning stage (C)	Operations stage (D)
Accountability (1) Defines accountability for meeting the project's objectives and allocating the risk to those objectives.	**A1.1** Design stage · Construction stage · Commissioning stage · Operations stage Departments should maintain clear distinctions between their sponsor, customer, funder and shareholder functions. Departments should retain oversight but allow the delivery organisation to earn its autonomy to do its job, particularly after the joint endeavour of the design stage concludes. **A1.2** Design stage · Construction stage · Commissioning stage · Operations stage Ensure clear organisational accountability for systems integration at the outset with a suitably capable and empowered organisation with the right to direct the integration activities of all relevant organisations. Ensure there is an empowered authority overseeing an integration strategy and progressive test plan.	**B1.1** Design stage · Construction stage · Commissioning stage · Operations stage Multi-party sponsorship may be required to protect the interests of separate funders. Carefully designed arrangements can provide effective oversight and challenge but can be more difficult to establish and operate. Guard against diluted accountability and ensure relationships and behaviours can sustain a collegiate approach when issues emerge. **B1.2** Design stage · Construction stage · Commissioning stage · Operations stage Decision makers need to take decisive action when evidence indicates that schedule or cost tolerances will be breached. Assumptions that adverse trends can be recovered or that further analysis will uncover better news are normally unrealistic and they should instead treat the project as being in exception until it is recovered, re-base lined or closed.	**C1.1** Design stage · Construction stage · Commissioning stage · Operations stage Ensure there is a single organisation accountable for the go/no-go decision to enter service and that it communicates the point of no safe return. Focus the go/no-go decision on protecting current end-users. Ensure that all relevant parties can contribute to the go/no-go decision using pre-agreed readiness criteria.	
Authority (2) Provides for effective decision-making and assigns authority to make decisions and commitments.	**A2.1** Design stage · Construction stage · Commissioning stage · Operations stage The Board of the delivery organisation should be the primary means of ensuring that its major projects are delivered once underway. Ensure that some Board members have relevant project skills and experience and are charged explicitly through the Chair with challenging confidence in the strategic delivery risks. Evolve the Board to bring in fresh perspectives. **A2.2** Design stage · Construction stage · Commissioning stage · Operations stage Early in the project define control gates and the objective criteria to determine whether they should be passed, including benefits, affordability, and value for money. Decision makers must be rigorous and make objective judgements on whether the criteria are met and, if not, they should conduct a strategic review of scope, schedule and consider potential cancellation.	**B2.1** Design stage · Construction stage · Commissioning stage · Operations stage Maintain an ongoing focus on benefits as well as cost and timescale. Adopt a benefits-led approach to decision-making in order to protect direct and indirect benefits, for example if emergent cost pressures threaten scope. Develop close working with other Departments where indirect benefits require aligned policies and plans due to split accountabilities. **B2.2** Design stage · Construction stage · Commissioning stage · Operations stage Establish integrated plans that join up activities across Department boundaries to achieve timely approval at control gates, policy clearance, and support for the delivery of wider benefits. Ensure that dependencies from the sponsor and other organisations are tracked and fulfilled in support of the delivery organisation.	**C2.1** Design stage · Construction stage · Commissioning stage · Operations stage Collect and review cost data across government and use cross-sectoral and international comparisons for common cost items. Challenge the delivery organisation and its supply chain to evidence their cost estimates. Ensure this evidence employs both top-down and bottom up benchmarking to test value for money.	
Alignment (3) Maintains alignment between corporate strategy/objectives and those of the project.	**A3.1** Design stage · Construction stage · Commissioning stage · Operations stage Evolve the sponsorship role over the project lifecycle. Ensure governance and reporting structures, oversight and the capabilities of the delivery organisation adapt ahead of the next stage to ensure the required capability and capacity. Be prepared to assist the delivery organisation if it is facing challenges but do not duplicate roles or blur accountability. **A3.2** Design stage · Construction stage · Commissioning stage · Operations stage Sponsors should consider the scale and complexity of their plans and develop a feasible and affordable scope with the delivery organisation based on a commonly understood set of requirements. Hold steady scope, requirements and the funding envelope to provide a stable environment within which successful outcomes can be achieved.	**B3.1** Design stage · Construction stage · Commissioning stage · Operations stage Reduce systems integration risk by limiting complexity. Ensure that the delivery organisation's commercial model packages systems work in a way that reduces systems integration risk, incentivises suppliers to work collaboratively across contract boundaries, and manages contentions for skilled integration resources. **B3.2** Design stage · Construction stage · Commissioning stage · Operations stage Invest in building good relationships between the sponsor, delivery organisation and its principal suppliers. Trust, confidence, and open communications are essential in pre-empting strategic risks by avoiding misperceptions, coming to a shared view of the extent of challenges, and collectively agreeing the right corrective action.	**C3.1** Design stage · Construction stage · Commissioning stage · Operations stage Make a conservative provision for the duration of the test phase as issues that emerge can require a wide range of fix times. Undertake progressive testing where possible to avoid late emerging defects. Resist the tendency to compress the test phase against a fixed in-service date when preceding phases are delayed and instead review the in-service date. **C3.2** Design stage · Construction stage · Commissioning stage · Operations stage Prepare in advance explicit and documented contingency plans for the more significant adverse events that could arise and review these for each phase. They should include the safest alternate plan if a "no-go" decision is taken at the point of commissioning and it becomes necessary to minimise impact on both the project and on wider operational services.	**D3.1** Design stage · Construction stage · Commissioning stage · Operations stage In tightly coupled systems manage all major projects as a single portfolio using a properly resourced and empowered portfolio office. Monitor the total amount of change planned, the risk of combined impacts on the operational service, and the consequential impacts of potential issues on end-users and dependent projects. **D3.2** Design stage · Construction stage · Commissioning stage · Operations stage Recognise that the introduction of a major new capability may have initial operational issues however good the planning and testing. Plan for the worst internally and communicate on the basis that disruption may occur, including with end-users, and prepare resilient recovery plans.
Disclosure (4) Defines the disclosure of information required to assure stakeholders that the project is set to meet its objectives, or inform corrective action if not.	**A4.1** Design stage · Construction stage · Commissioning stage · Operations stage Avoid setting a committed in-service date before there is positive evidence that it is realistically achievable. Caveat dates as provisional and use a range showing the best case and worse case dates. Report progress using standardised percentage confidence indicators against the optimistic, central point and backstop in-service dates. **A4.2** Design stage · Construction stage · Commissioning stage · Operations stage Establish a full cost envelope based on reference class data and benchmarking and include adjustments for optimism bias. Identify explicit de-scoping options in case early affordability issues emerge after supplier prices become available. Report projected outturn costs with percentage confidence indicators against the target cost and total budget envelope.	**B4.1** Design stage · Construction stage · Commissioning stage · Operations stage Behavioural traits make it hard to make objective judgements about delivery confidence. Foster a culture of transparency and early warning supported by progress reporting focused on cost and schedule variance. Triangulate views and maintain a healthy scepticism whilst checking back to real world evidence. **B4.2** Design stage · Construction stage · Commissioning stage · Operations stage Target independent assurance on the primary strategic risks to benefits, schedule, cost, commercial strategy and systems integration through an integrated assurance plan to improve confidence in key decisions. Interpret assurance opinions carefully, avoid assurance for its own sake, and recognise that assurance cannot eliminate risk or replace careful judgment.	**C4.1** Design stage · Construction stage · Commissioning stage · Operations stage Ensure lessons identified in other major projects are reviewed at the design stage and ahead of each stage transition to ensure strategies and approaches that actively address the principal recurring issues. Make sure the main project successes and failures are captured soon after they occur so that they are available for other project leaders to consider. **C4.2** Design stage · Construction stage · Commissioning stage · Operations stage Control schedule risk with the same discipline as cost risk. Consider controlling primary milestones and some schedule contingency at the Departmental level. Ensure reporting provides confidence indicators against the primary milestones and against the remaining contingency. Communicate schedule risks to dependent projects early and automatically.	**Categorisation of lessons by theme** Accountability must be unambiguous Behaviour matters more than process Control schedule and benefits as well as costs Deal with systems integration Enter service cautiously

A1.1 Ensure clarity of role and the extent of autonomy

Lesson	**A1.1** Design stage · Construction stage · Commissioning stage · Operations stage Departments should maintain clear distinctions between their sponsor, customer, funder and shareholder functions. Departments should retain oversight but allow the delivery organisation to earn its autonomy to do its job, particularly after the joint endeavour of the design stage concludes.
Explanation	Departments have multiple roles in relation to major projects including acting as funder, sponsor, shareholder, customer and sometimes as direct client. The Departments may deliver major projects through a range of structures including directly, through ALBs managing a portfolio of smaller and large projects, or through single purpose ALBs. Complex structures and overlapping responsibilities can increase delivery risk. Departments should ensure each function is clear in its role and acts consistently with it and in harmony with the other functions. A lack of clarity over which role the Department is undertaking and its relationship with the roles of the delivery organisation can lead to conflict and blurring of accountabilities. In its sponsor role the Department may establish, set the direction, and provide funding for the delivery organisation, which in turn contracts with its supply chain to deliver the project. The Department may contract directly with suppliers for some projects. For others, such as maintenance or enhancement of infrastructure, the Department may act as a client to the delivery organisation but not undertake the wider sponsor functions such as policy development and business case approval. The shareholder function's role is to hold the delivery organisation to account for its corporate performance and to establish the control and incentive framework for the LAB and not to monitor or oversee the delivery of individual projects as this is the role of the sponsor team. The shareholder and sponsor team should operate separately to avoid conflicts but need to be joined up to ensure that the framework agreement and Board appointees are meeting the needs of the full remit of work including the major projects. This is especially important when the delivery organisation is a single purpose ALB which exists only to deliver a single major project. Departments need to strike the balance between overall control and empowering the delivery organisation to do its job. The right balance depends on the project stage, the delivery organisation's capability and the sponsor's risk appetite. Whatever the extent of autonomy, the sponsor will need to continue to provide oversight and challenge. Excess control can give false comfort if the sponsor impedes the ability of the delivery organisation to do what it is good at. So long as the deliver organisation is performing then it should be given earned autonomy, particularly after the extent of joint endeavour reduces at the end of the design stage.
Theme	**Accountability must be unambiguous**

Source of lesson	Timetabling	Crossrail	GWE	Highways	Other
	✔	✔		✔	✔

A1.2 Ensure clear organisational accountability for systems integration

Lesson	**A1.2** Design stage · Construction stage · Commissioning stage · Operations stage Ensure clear organisational accountability for systems integration at the outset with a suitably capable and empowered organisation with the right to direct the integration activities of all relevant organisations. Ensure there is an empowered authority overseeing an integration strategy and progressive test plan.
Explanation	System integration in this context means the technical and programmatic integration of the engineering components of the infrastructure system to allow it to operate as designed. The delivery of the intended benefits also needs the strategic integration of the integrated system with the existing operating environment including its personnel and maintenance and safe entry into service (see D3.1). Issues can arise in all engineering disciplines but most often arise in relation to information and communications systems. As infrastructure projects become more dependent on ICT to realise their benefits, systems integration risk is becoming more prevalent. These risks manifest themselves most often where there are multiple ICT interfaces and where legacy systems and new systems interact. System integration risks are less tangible than safety or schedule risks and the skills and capabilities necessary to address them are often scarce. Attention to systems integration can be crowded out by the focus on the more proximate risks to schedule and cost. It is important therefore to establish the conditions for successful system integration early in the project lifecycle by ensuring that there is clear accountability for mitigating these risks and a documented integration strategy. This should be based on an agreed and documented systems architecture within which the development of subsystems can be undertaken knowing the target state and configuration and the expected interaction with the existing operational system. That is often best achieved through a single organisation with sufficient technical capability. It can be challenging to secure personnel who have both systems integration skills and relevant domain knowledge. This is likely to require specialist resources either within the delivery organisation, acting on behalf of the delivery organisation, or acting as a prime integrator in the supply chain. A different organisation and skillset may be needed to conduct the safe entry into service but the respective accountabilities for the systems integration and strategic integration roles should be explicit (see C1.1). The accountable integration authority needs to be empowered to direct the actions of other organisations to achieve successful integration by acting as the controlling mind and to be backed by the executive of the delivery organisation in implementing its conclusions. This can be achieved through, for example, an integration authority within the project governance and contractual rights to make trade-offs and enforce integration decisions. These decisions are potentially in conflict with the interests of individual suppliers but may be necessary for the overall success of the project. In these cases contractual action may be required to overcome narrow self-interest when under commercial pressure.
Theme	**Deal with systems integration**

Source of lesson	**Timetabling**	**Crossrail**	**GWE**	**Highways**	**Other**
		✔	✔		✔

A2.1 Hold the delivery organisation's Board to account for controlled delivery

Lesson

A2.1 Design stage | Construction stage | Commissioning stage | Operations stage

The Board of the delivery organisation should be the primary means of ensuring that its major projects are delivered once underway. Ensure that some Board members have relevant project skills and experience and are charged explicitly through the Chair with challenging confidence in the strategic delivery risks. Evolve the Board to bring in fresh perspectives.

Explanation

Departments typically wholly own the delivery organisation, provide its funding and determine its aims, objectives and corporate governance through a framework agreement. They may also provide a development agreement if the delivery organisation is a single purpose body for a particular major project or projects. If done correctly the documentation makes clear the accountability and responsibilities, and places delivery firmly with the delivery organisation.

Despite the Department's role in establishing and overseeing it, it is the Board of the delivery organisation that is charged with ensuring that the Department's requirements are being met by the delivery organisation's executive through a combination of challenge and support. This includes that the supply chain is capable, incentivised, and provides value for money; and that the strategic delivery risks for the Department of timescale, cost, benefits and integration are being appropriately managed. The span of the Board's accountability may be very wide on complex and large-scale projects and the shareholder team should consider their capacity and structures.

The Department's sponsor team and its own Board should complement the delivery organisation Board's duties in this regard by using their own judgement to maintain oversight and challenge of progress and the strategic risks based on progress reporting and by commissioning independent assurance. But the aim in the first instance is to be confident in the delivery organisation Board's control of its executive.

The Department's shareholder function will also typically appoint the chair and some, or all, of the delivery organisation non-executive directors. In doing so for organisations delivering major projects, the Department should ensure that those directors it appoints have skills and expertise relevant to major project delivery and that these are not just infrastructure construction skills. This is in addition to their general suitability as a corporate director and the need to balance the styles and experience of the Board as a whole.

The shareholder function should consider whether the chair and directly appointed non-executive directors are explicitly and formally charged through their letters of appointment with protecting the sponsor's interests in relation to its requirements, benefits, and management of the strategic delivery risks. The balance of styles, skills and experience for the Board will need to evolve over the major project's lifecycle and the shareholder function should consider their appointment decisions and succession planning to ensure sufficient major project skills and experience for the current and forthcoming stages even if current arrangements seem strong. As part of this, assessments of the suitability of skills and balance on the Board for the current and forthcoming stages should be audited periodically.

Theme

Accountability must be unambiguous

Source of lesson	Timetabling	Crossrail	GWE	Highways	Other
		✔			✔

A2.2 Use control gates to step back and consider status objectively

Lesson	**A2.2** Design stage · Construction stage · Commissioning stage · Operations stage Early in the project define control gates and the objective criteria to determine whether they should be passed, including benefits, affordability, and value for money. Decision makers must be rigorous and make objective judgements on whether the criteria are met and, if not, they should conduct a strategic review of scope, schedule and consider potential cancellation.
Explanation	Very few projects that encounter challenges are cancelled and those that are reset are often reset during crises rather than in a controlled manner. The business case stages (strategic outline case, outline case and full case) create natural control gates for major projects. However, these business cases can be several years apart and much activity will take place between them, including the emergence of strategic risks. Even after the investment decision it is beneficial for the Department to maintain oversight and challenge through additional control gates around project lifecycle stage boundaries and other key decisions such as the submission of legislation or planning applications, finalisation of the proposed delivery model, or sign-off of the commissioning readiness plan. These control gates, if used with discipline, should provide the opportunity to step back and review progress objectively against the parameters of cost, schedule and benefits for the project. It is important to identify these points and the maturity criteria associated with them early in the project's lifecycle. Doing so ensures that the conduct of the gates themselves is not crowded-out or delayed by short-term pressures. It also allows the project team to know the maturity threshold they are aiming towards. Agreeing and documenting the control gates and maturity criteria near the project's outset and applying strict change control to these criteria helps to guard against a natural tendency for decision makers to soften the maturity threshold in the heat of decision making to maintain the project's momentum and to avoid the difficult choice to pause, reset or stop. The control gates and maturity criteria may be changed as more information emerges but this must be through formal and robust change control. The use of independent reviewers or "red team" methodologies can add objectivity and challenge to these assessments. Setting such a control gate around readiness to start commissioning well ahead of the actual start of this phase, potentially years in advance, can be an important catalyst for the necessary change in mind-set from construction to entry-into-service and operation.
Theme	**Behaviour matters more than process**

Source of lesson	Timetabling	Crossrail	GWE	Highways	Other
	✔	✔	✔	✔	✔

A3.1 Evolve governance and personnel across the lifecycle stages

Lesson	**A3.1** Design stage · Construction stage · Commissioning stage · Operations stage Evolve the sponsorship role over the project lifecycle. Ensure governance and reporting structures, oversight and the capabilities of the delivery organisation adapt ahead of the next stage to ensure the required capability and capacity. Be prepared to assist the delivery organisation if it is facing challenges but do not duplicate roles or blur accountability.
Explanation	The nature of sponsorship should evolve and failure to do so can mean previously successful approaches fail in the next stage. Changes may be required across the project lifecycle stages in the level of oversight and autonomy, the governance structures, legal agreements, and the capacity and capability of the sponsor team, delivery organisation and its Board. During the design stage the sponsor Department will be more participative as it establishes the legislative and organisational arrangements for delivering the project, secures investment approval, and establishes and iterates its requirements with the delivery organisation. Once the main investment decision is made the delivery organisation should gain more autonomy with the sponsor adopting more of an oversight and challenge role. The sponsor should ensure that the delivery organisation achieves a marked transition from the build to commissioning stage. This is likely to require a significant change of mindset, focus and capability to manage the systems integration risks and to ensure a safe entry into service. As part of this, Departments and delivery organisations should evolve the governance structures so that they remain appropriate to the lifecycle stage of the project. This should include a review of the structures themselves together with the skills and experience of Board members and executives. The capability and capacity of the team within the Department depends on the Department's role, the nature of the project, the project stage, and the delivery organisation's maturity. The Department must steer between over-staffing – when it may intrude and duplicate roles it should have delegated; and under-staffing – when it may lose the ability to oversee the delivery organisation or to step in if necessary. In the case of a new delivery organisation the sponsor may need to provide more support and assistance in the early stages until it is established and operating effectively. Both organisations need to guard against paternalism in this context as the sponsor must step back to allow the delivery organisation to develop and deliver. The sponsor should be prepared to assist the delivery organisation if there are significant ongoing challenges but should do so without duplicating roles or blurring accountability. To manage this risk, it should operate under the direction of the delivery organisation in areas that have been delegated. In extremis it may need to step in and take back previously delegated functions but should consider this a last resort following repeated failures.
Theme	**Accountability must be unambiguous**

Source of lesson	Timetabling	Crossrail	GWE	Highways	Other
		✔		✔	✔

A3.2 Maintain a stable scope and operating environment

Lesson	**A3.2** Design stage · Construction stage · Commissioning stage · Operations stage Sponsors should consider the scale and complexity of their plans and develop a feasible and affordable scope with the delivery organisation based on a commonly understood set of requirements. Hold steady scope, requirements and the funding envelope to provide a stable environment within which successful outcomes can be achieved.
Explanation	Sponsors should assess carefully the scale and complexity of the project they seek delivered and ensure it is manageable in relation to the overall Departmental capacity and within the reasonable capabilities of the existing or new delivery organisation. Ideally the Department will establish clear requirements for the delivery organisation, iterate these to secure an affordable project, and then hold steady the requirements and funding to provide a stable and predictable environment within which the delivery organisation can operate. This can only realistically occur when sufficient development and iteration has been undertaken to identify a firm and affordable budget with sufficient contingency (see A4.2). The Department should ensure that this includes sufficient provision to provide the resources needed in the sponsor team and delivery organisation to oversee and deliver the project. The sponsor and delivery body should ensure they invest in developing a detailed joint understanding of the sponsor's requirements, including with the supply chain, so there is collective understanding of the scale of the task, complexity, trade-offs and priorities. The sponsor should be open to constructive challenge on requirements from the delivery body and its supply chain and should consider amendments to reduce cost, reduce complexity and increase standardisation. There are advantages in ensuring that the delivery organisation's chair and Board explicitly agree that the scope is realistic and affordable at the investment decision so that the investment decision is taken with confidence and that the delivery organisation does not view cost and schedule parameters as externally imposed conditions. Following investment approval and project mobilisation, changes to funding or requirements by the Department and its ministers can have very significant impacts on the planned budget and schedule with these impacts being more acute the further into the project lifecycle they occur. Even with effective change management, such alterations are very likely to have high opportunity costs and to impact schedule and productivity. In some circumstances these may be necessary, for example if there is a major change in political direction or if funding is diverted away from the Department. Outside these externalities Departments should resist urges to make changes due to policy refinement or changing internal priorities and should avoid over-programming their portfolio excessively so that deferment or scope reduction of projects is necessary for in-year budget management reasons.
Theme	**Accountability must be unambiguous**

Source of lesson	**Timetabling**	**Crossrail**	**GWE**	**Highways**	**Other**
		✔	✔	✔	✔

A4.1 Use an evidenced range rather than a single target date

Lesson

A4.1 Design stage | Construction stage | Commissioning stage | Operations stage

Avoid setting a committed in-service date before there is positive evidence that it is realistically achievable. Caveat dates as provisional and use a range showing the best case and worse case dates. Report progress using standardised percentage confidence indicators against the optimistic, central point and backstop in-service dates.

Explanation

It is common to set in-service dates for major projects using an aspirational date before there is reasonable evidence or advice on its achievability. Sometimes this is a political commitment whereas in other circumstances it may be a policy ambition.

This is typically done more casually than would be the case with a budget, where there are stronger financial controls and more systematic adjustments for optimism bias and contingency. The view is sometimes held that the project is bound to slip anyway and that delivery organisations are conservative in estimation so setting a demanding target is the best way of expediting progress and encouraging the right effort. In practice duration is a major cost driver and a project planned on the basis of an unrealistic schedule is likely to be late which will in turn breach the planned budget. Unnecessary costs may also be incurred attempting to accelerate delivery against an unachievable deadline. Late projects can then have a detrimental impact on the wider portfolio as they contend for resources or impact upon dependent projects (see C4.2 and D3.1). Sufficient time should be invested between the sponsor, delivery organisation and supply chain to optimise cost and schedule before committing irrevocably to either.

The consequences of establishing an aggressive in-service date can be significant in terms of decisions that compromise quality and cost to hold schedule, a reluctance to step back and re-plan when significant issues arise, and a corrosive effect on morale and well-being when teams are asked to operate beyond their sustainable tempo for long periods.

Aspirational in-service dates should be recognised as provisional by ministers and senior officials until they have been subject to detailed bottom-up and left-to-right planning including optimism bias adjustments, reference class analysis, schedule contingency and validation with the delivery organisation and its supply chain. They should then be established as ranges based on three-point estimates of the most likely date, an earliest achievable date and a backstop date that can achieve high levels of confidence. Use of such ranges will signal internally and externally the imprecise nature of schedule planning and real-world delivery.

Theme

Control schedule and benefits as well as costs

Source of lesson	Timetabling	Crossrail	GWE	Highways	Other
	✔	✔	✔	✔	✔

A4.2 Set a realistic cost envelope

Lesson	**A4.2** Design stage · Construction stage · Commissioning stage · Operations stage Establish a full cost envelope based on reference class data or benchmarking and include adjustments for optimism bias. Identify explicit de-scoping options in case early affordability issues emerge after supplier prices become available. Report projected outturn costs with percentage confidence indicators against the target cost and total budget envelope.
Explanation	Cost estimation for major projects is more mature than schedule estimation but remains inadequate. Most major projects follow Green Book guidance and adjust for optimism bias. The provision of additional contingency is becoming more prevalent. Reference class data and cost benchmarking however remain underused and should be employed to develop better defined and more realistic estimates based on actual outturns from real projects. Sensitivity analysis should be used to make sure that the project continues to offer good value and remains affordable should substantial cost increases arise. Cost estimates are unlikely to be reliable until design work is relatively advanced and estimates ahead of that should use ranges of confidence indicators to signal this uncertainty. Many projects have to reconsider their initial scope once firm prices are provided by the supply chain, in response to undertakings and assurances needed to get planning consents, or if costs increase during early stage construction. Major projects should identify in advance feasible scope reductions that can be executed in these circumstances to reduce costs without compromising the overall business case (a "Norwegian list"). To be effective these scope reductions need to be operationally achievable, reduce costs and sustain sufficient benefits to continue to warrant the investment. They should also avoid displacing costs to others within the overall operating environment or incurring future operating costs to address immediate capital shortfalls. In order to minimise increases in cost and changes to scope after the business cases have been approved and targets communicated, projects should invest more in early stage planning (for example with a greater use of more detailed Building Information Modelling (BIM) to get greater clarity on scope and specifications). Significant economies can also be identified and achieved through design simplification and standardisation both within and across projects with shared components. Although progress and risk reporting against budget is more objective than schedule reporting, Departments should go further and require standardised reporting by delivery organisations. This should include a projected outturn estimate against both the target cost and total budget envelope and confidence indicators for each. This ensures a focus on the full cost and allows more nuanced conversations on the level of cost risk that is being carried.
Theme	**Control schedule and benefits as well as costs**

Source of lesson	Timetabling	Crossrail	GWE	Highways	Other
		✔	✔		✔

B1.1 Joint sponsorship requires careful design and operation

Lesson

B1.1 Design stage | Construction stage | Commissioning stage | Operations stage

Multi-party sponsorship may be required to protect the interests of separate funders. Carefully designed arrangements can provide effective oversight and challenge but can be more difficult to establish and operate. Guard against diluted accountability and ensure relationships and behaviours can sustain a collegiate approach when issues emerge.

Explanation

In some circumstances a single major project may be sponsored by multiple organisations including two or more Departments, or combinations including central government, local government, and/or devolved administrations.

Funders will rightly expect to have a sponsorship role and when carefully designed and agreed joint arrangements can provide effective oversight and control. If arrangements are ineffective they risk conflicting direction, duplicative assurance, divergent interests and diluted accountability.

Each sponsor should retain full accountability for ensuring the delivery of the agreed joint requirements and benefits so that the public funds it contributes secure value for money. Each sponsor must consciously avoid assuming that its obligations can be met through the diligence of their counterparty. Compromises may be necessary on requirements and priorities requiring well-developed relationships and behaviours. Together these demand vigilance, trust and close cooperation between sponsors. This can be severely tested if major delivery issues arise.

Simpler accountability can be achieved if the joint sponsors are able to agree that one of the sponsor organisations will take the lead in overseeing project delivery by the delivery organisation, notwithstanding the difficult decisions needed to reach this position. A funder can still ensure their interests are protected even if it is not the owner and primary scrutineer of the delivery organisation.

Theme

Accountability must be unambiguous

Source of lesson	Timetabling	Crossrail	GWE	Highways	Other
		✔			✔

B1.2 Act decisively when in exception

Lesson	**B1.2** Design stage · Construction stage · Commissioning stage · Operations stage Decision makers need to take decisive action when evidence indicates that schedule or cost tolerances will be breached. Assumptions that adverse trends can be recovered or that further analysis will uncover better news are normally unrealistic and they should instead treat the project as being in exception until it is recovered, re-base lined or closed.
Explanation	There is a predisposition for Departments to hope that adverse cost or schedule trends reported by delivery organisations are either overly pessimistic or can be recovered. There is often a preference to wait to determine whether the operating environment will present more favourable circumstances to expose the challenges. This includes both projections that in-service dates or outturn budgets will be missed, the fact that intermediate milestones have not been hit, or that spend-to-date significantly exceeds achievement against planned work. Although most obvious in relation to schedule and cost, failures to act decisively can also occur in relation to diminishing benefits, aggregation of risks, and threats to the resilience of operations. There is little evidence that predicted or actual delays can be recovered by Departmental action to increase spending or by waiting to see how things develop. Conversely, the Department can worsen the situation for the major project and wider portfolio by denying the situation and failing to act early and decisively once the assessment has been validated between the Sponsor and delivery organisation. In these circumstances the Sponsor should put the project into exception and develop a revised plan in conjunction with the delivery organisation, despite the impact of having to announce the change. The practical and reputational consequences of resetting understandably lead to a reluctance to contemplate establishing a revised baseline and emphasise the importance of having budgets and schedules that are realistic in the first place and contain sufficient contingency to absorb set-backs. However, a reset remains the least bad course of action due to the damaging effect on control, morale, future users and the wider portfolio of continuing with a project that is undeliverable within its current budget and timescale. Often the impact of having to reset later, and potentially closer to the in-service date, will be greater. In the extreme the project may not be recoverable even with a reset and if this is the case then the proper course of action is to recommend its closure. Notwithstanding the pressure to limit slippage, when a reset is required it is normally better to take the time and impact of providing a higher level of confidence in the revised cost and schedule envelopes rather than underproviding which can necessitate a further reset.
Theme	**Behaviour matters more than process**

Source of lesson	Timetabling	Crossrail	GWE	Highways	Other
	✔	✔	✔		✔

B2.1 Protect benefits

Lesson	**B2.1** Design stage · Construction stage · Commissioning stage · Operations stage Maintain an ongoing focus on benefits as well as cost and timescale. Adopt a benefits-led approach to decision-making in order to protect direct and indirect benefits, for example if emergent cost pressures threaten scope. Develop close working with other Departments where indirect benefits require aligned policies and plans due to split accountabilities.				
Explanation	Risks to benefits typically follow cost and then schedule in their priority on government major projects. Benefits are often largely delivered after the major project completes and, compared with private sector projects, are less directly tangible, realised through more objectives, and more distributed across the country and economy. Departments should ensure that decisions are benefit-led so that the impact of potential delays, cost increases, or scope changes are taken considering the anticipated impact on direct benefits. The local benefits delivered through the major project should also be weighed against their contribution to the overall capability. In some circumstances the local benefits could be temporarily detrimental to the existing system if they unbalance it. Direct benefits are within the control of the Department and will be enabled by the outputs of the major project. Wider economic benefits, or indirect benefits, will typically be beyond the ability of the project teams to deliver directly. For example, the benefits of regeneration that require housing development enabled by a transport project. Departments need to cooperate closely and undertake integrated policy and planning to realise these benefits and manage the divided accountabilities carefully as interdepartmental structures are rarely established to align with the major project.				
Theme	**Control schedule and benefits as well as costs**				
Source of lesson	**Timetabling** ✔	**Crossrail** ✔	**GWE** ✔	**Highways** ✔	**Other** ✔

B2.2 Join up across Departments

Lesson	**B2.2** Design stage · Construction stage · Commissioning stage · Operations stage Establish integrated plans that join up activities across Department boundaries to achieve timely approval at control gates, policy clearance, and support for the delivery of wider benefits. Ensure that dependencies from the sponsor and other organisations are tracked and fulfilled in support of the delivery organisation.
Explanation	Major projects that are above the delivery organisation's delegation very often require approval from both the Department and HM Treasury (HMT) with associated scrutiny by the Cabinet Office. Failure to identify and agree these interdepartmental inputs (for example a policy decision from a Department or a non-business case approval from HMT) and ensure proper understanding of the dependency for the project and impact on its schedule can result in unnecessary delays to projects. Parties need to work collaboratively to identify and document these inputs and ensure they are captured in a single, integrated approvals plan and timeline that can be used to support effective governance of the project, and hold parties to account for the timely and successful delivery of their respective inputs. Major projects can also cut across Departmental responsibilities for policy areas and in enabling the delivery of wider benefits. In these cases the sponsor Department should take responsibility for winning timely policy approval and act to secure agreement for collaborative work to realise second order benefits. Project funds are often controlled annually on total nominal capital and resource costs over spending review periods in line with wider government financial controls. This is the case even if the project is a long-term and multi-stage endeavour. This approach is not always aligned to the delivery of best value as it can constrain project flexibility to maximise benefits and can also detract focus from minimising whole-life costs if, for example, capital costs are reduced due to short term pressures but generate greater longer term operational costs.
Theme	**Accountability must be unambiguous**

Source of lesson	Timetabling	Crossrail	GWE	Highways	Other
				✔	✔

B3.1 Reduce systems integration risk by controlling complexity

Lesson

B3.1 Design stage | Construction stage | Commissioning stage | Operations stage

Reduce systems integration risk by limiting complexity. Ensure that the delivery organisation's commercial model packages systems work in a way that reduces systems integration risk, incentivises suppliers to work collaboratively across contract boundaries, and manages contentions for skilled integration resources.

Explanation

Sponsors can inadvertently increase technical systems integration risk by establishing requirements which encourage "bleeding edge" specifications and require solutions that cannot be met with proven technology and require new technologies or new combinations of technology to address.

In this context systems integration risk can be managed by Departments by seeking engineering advice on the requirements that they are setting, mindful of the complexity that the necessary solutions may exhibit. Engineering advice will have the most impact during the design stage and sponsors should be prepared to compromise where necessary to reduce solution complexity to manageable levels. They should ensure that complexity and costs are not being driven by requiring compliance with outdated standards or over-embellished requirements.

Systems integration risk is likely to be greater when Departments seek to integrate new systems into existing complex systems where both internal and external integration boundaries will occur. The configurations and behaviours of the existing system may be poorly understood and badly documented leading to unexpected interactions with the new system.

In contrast the development of wholly new or isolated systems can reduce overall systems integration risk as the systems integration issues are limited to internal boundaries which can be designed from first principles to integrate.

Departments should also ensure that delivery organisations package the work they procure in a way that reduces the number and complexity of technical interfaces between their suppliers, provides incentives to collaborate on managing systems interfaces and manages contentions for scarce skilled integration resources that also have a good understanding of the domain.

Theme

Deal with systems integration

Source of lesson	Timetabling	Crossrail	GWE	Highways	Other
	✔	✔	✔		✔

B3.2 Invest in building relationships between leaders

Lesson	**B3.2** Design stage · Construction stage · Commissioning stage · Operations stage Invest in building good relationships between the sponsor, delivery organisation and its principal suppliers. Trust, confidence, and open communications are essential in pre-empting strategic risks by avoiding misperceptions, coming to a shared view of the extent of challenges, and collectively agreeing the right corrective action.
Explanation	Strong relationships at all levels between the Department, delivery organisation and its principal suppliers are an essential complement to clear accountabilities and effective procedures. Departmental personnel risk perceiving delivery organisations as insufficiently capable and motivated, or alarmist when delivery problems arise or are forecast against a requirement-time-cost envelope the sponsor has often established without significant delivery organisation or supply chain input. Departments can sometimes be more focused on lack of delivery by the delivery organisation than on their own obligations, on which the delivery organisation may depend. Delivery organisation personnel risk perceiving the Department as having overoptimistic schedule and cost assumptions, as being risk averse about the presentational impacts of changes to schedule or scope, and as being overly intrusive by failing to give the delivery organisation the operational freedom to achieve the purpose for which it was established. The personal relationship between the senior lead in the Department (typically the SRO) and the delivery organisation chief executive is vital in countering these challenges by ensuring there are well developed channels for open and honest communication when issues arise and in setting the right tone and behaviours within each organisation. This can be complemented by the relationship between the Department, including ministers, and the chairperson of the ALB Board. The delivery organisation needs to own the relationship with its principal suppliers and Sponsors should not undermine this. However, there can be powerful messages and benefits in trilateral meetings to demonstrate Sponsor support and engagement, to ensure alignment of all parties' understanding of requirements and priorities, and so that all leaders develop a common understanding of the challenges and delivery confidence. Poor relationships can have serious impacts when schedule or cost issues arise or are projected. Leaders may fail to invest in coming to a common view of the nature and extent of the challenge leading to suboptimal responses. The Department may overreact to early warning signs of schedule or cost risk by interpreting them as more serious than they are, or by being critical of the decision to raise them. This can deter the delivery organisation from sharing time or schedule risks as soon as they arise for fear of generating a reaction by the Department that impedes the actual ability to mitigate the risk itself. Equally the Department may underreact to a serious schedule or cost risk if it misperceives the likelihood, or assumes that the delivery organisation is crying wolf.
Theme	**Behaviour matters more than process**

Source of lesson	Timetabling	Crossrail	GWE	Highways	Other
	✔	✔	✔	✔	✔

B4.1 Challenge the objectivity of delivery confidence assessments

Lesson

B4.1 Design stage | Construction stage | Commissioning stage | Operations stage

Behavioural traits make it hard to make objective judgements about delivery confidence. Foster a culture of transparency and early warning supported by progress reporting focused on cost and schedule variance. Triangulate views and maintain a healthy scepticism whilst checking back to real world evidence.

Explanation

It is challenging to make objective judgements about a major project's delivery confidence as this relies both on judging future events and countering a range of unhelpful behavioural traits including:

- Optimism bias about schedule and cost
- A preference to wait rather than act on adverse trends
- Hostility towards those conveying bad news
- Aversion to admitting issues or failure to those in authority including ministers
- Willingness to ignore issues outside one's direct responsibility
- Overly associating with one's own organisation in opposition to another's
- Blaming other organisations ahead of taking collective action to solve the problem
- Favouring evidence that reinforces ones existing views (confirmation bias)
- Aversion to maintaining views that conflict with others (group think).

The underlying format and data reported can also be unfocused and inconsistent. Different progress reporting approaches across major projects even in the same Department can make it difficult to interpret reports consistently. Departments should focus on the strategic risks to delivery of schedule and cost variance and their impact on benefits. Delivery organisations should prioritise these in their reporting to Departments and have these metrics and the trends for each metric prominent in reporting. Departments should monitor changes to delegated schedule contingency carefully as this can indicate slippage.

Departments and delivery organisations should consciously adopt transparent reporting procedures where nothing of significance is withheld, risks are escalated as soon as they are identified on a precautionary basis, and reporting information to the Department is identical to that to the delivery organisation's executive and Board. The early escalation of issues should be rewarded not deterred by a hostile reaction by the recipient. Collectively, the organisations need to be able to discriminate effectively and consistently between projected issues (such as a projected cost overrun if corrective action is not taken) and actual issues (for example the schedule being irrecoverable already) and understand the certainty ascribed to the report.

Reported data appears to be objective but is always a subjective representation of the actual delivery status. Leaders should maintain a healthy scepticism about reporting data. They should triangulate views on schedule and cost risks by seeking views from multiple individuals and parties including the supply chain. They should test status, confidence and projections back to physical evidence where possible by observing actual progress in the field using their judgement and common sense to validate reports and assurances.

Theme

Behaviour matters more than process

Source of lesson	Timetabling	Crossrail	GWE	Highways	Other
	✔	✔	✔	✔	✔

B4.2 Recognise both the value and limitations of independent assurance

Lesson	**B4.2** Design stage · Construction stage · Commissioning stage · Operations stage Target independent assurance on the primary strategic risks to benefits, schedule, cost, commercial strategy and systems integration through an integrated assurance plan to improve confidence in key decisions. Interpret assurance opinions carefully, avoid assurance for its own sake, and recognise that assurance cannot eliminate risk or replace careful judgment.
Explanation	Poorly targeted, conducted or coordinated assurance can distract attention, dilute accountability and give false comfort. However, successful independent assurance can complement internal assurance by the delivery organisation in giving confidence in assessments of delivery confidence and the quality of information on which key decisions are taken by the Department and delivery organisation. Whilst it can reduce the risk of incorrect information and judgements, assurance cannot eliminate these problems. Assurance should consider the aggregated level of delivery risk alongside individual risks. Independent assurance should build on the delivery organisation's internal assurance and that of its supply chain and sponsors should challenge delivery organisations if they do not have evidence of robust internal assurance arrangements including at Board level. Sponsors should guard against the risk of delivery organisations failing to implement their own internal assurance regimes or prematurely demobilising them near the end of project. Achieving effective independent assurance is demanding and requires the right terms of reference, capable reviewers with relevant experience, unfettered access to information from the delivery organisation, and assurance leaders with the skill to maintain positive but objective relationships with the delivery organisation and with sufficient gravitas to influence the Department. Progressive assurance on behalf of the sponsor can provide deeper insights as it allows continuity of reviewers that gain familiarity with the context. However, it is resource intensive and there is a risk of the reviewers losing objectivity and critical distance over time. A well formulated assurance strategy and Integrated Assurance and Approval Plan can ensure that assurance is value adding, is not duplicative between assuring organisations, and is targeted on the primacy risks and decision points. The delivery organisation's supply chain is fundamental to delivering the major project. Sponsors should assure the approaches taken to design the packages of work in light of market capacity, the approach to secure value for money through competition and contestability, the robustness of the procurement approach to legal challenge, and the strength of contract management. Departments should interpret assurance findings carefully and only place weight on their findings proportionate to the quality and duration of the assurance event, and subject to the caveats that the assurers may place on their findings. Assurance does not displace the accountability of the leaders of the Department to make their own judgements on delivery confidence and the management of the strategic risks.
Theme	**Behaviour matters more than process**

Source of lesson	Timetabling	Crossrail	GWE	Highways	Other
		✔			✔

C1.1 Ensure clear accountability for the decision on whether to commission

Lesson

C1.1 Design stage | Construction stage | Commissioning stage | Operations stage

Ensure there is a single organisation accountable for the go/no-go decision to enter service and that it communicates the point of no safe return. Focus the go/no-go decision on protecting current end-users. Ensure that all relevant parties can contribute to the go/no-go decision using pre-agreed readiness criteria.

Explanation

The entry-into-service of a major project presents significant risks to both the project itself and to the wider system to which its capability will be added. The momentum of the project and the desire to deliver its intended outcomes must be weighed against the risks to the wider system and current users of a premature or disruptive entry-into-service. The current system and its users should have primacy in these judgements and the burden of proof should rest with the major project to demonstrate through evidence that it is ready to commission at a tolerable level of risk.

A badly judged or uncontrolled decision to proceed with commissioning when the new capability is not ready can be highly disruptive to users of the current system including causing potential safety risks. At the same time, a no-go decision can also have consequential impacts including lost benefits from the major project in question and to the wider system if wider changes were dependent on the new capability.

Managing this balance requires a controlling mind for the decision as to whether to "go" and commission the new capability or to take a "no-go" decision. The accountable organisation must be able to take an independent perspective spanning both the major project and the existing system and should take advice from the full range of interested organisations, some of whose interests may intrinsically be in conflict.

Careful planning is needed by the accountable organisation to identify and communicate widely the point of no return after which there will be operational impacts to the wider system even if a no-go decision is taken. This may be earlier than expected where there are complex dependencies and multiple organisations making their own plans on the basis that the entry into service will be successful.

Departments should ensure that the accountable organisation for this decision is identified early and that it develops objective criteria against which to judge readiness.

Departments should also guard against focusing overly on the technical aspects of commissioning and ensure the accountable organisation has considered wider readiness factors including personnel and training, operational, commercial and business change, and logistics.

Theme

Enter service cautiously

Source of lesson	Timetabling	Crossrail	GWE	Highways	Other
	✔	✔			✔

C2.1 Test value for money through benchmarking

Lesson	**C2.1** Design stage · Construction stage · Commissioning stage · Operations stage Collect and review cost data across government and use cross-sectoral and international comparisons for common cost items. Challenge the delivery organisation and its supply chain to evidence their cost estimates. Ensure this evidence employs both top-down and bottom up benchmarking to test value for money.
Explanation	Despite being one of the economy's largest buyers, parts of central government underinvest in activity and asset costing relative to other industries. This is both in relation to capturing and analysing a priori estimates from suppliers, and in assessing actual outturns. Without these data confidence in cost estimation remains low and Departments cannot drive value for money effectively from either the supply chain or the delivery organisations. To enable bottom-up costings, Departments should develop standardised cost structures across their delivery organisations, and require them consistently to invite bids against these and measure outturn using them. These data should be collected and analysed centrally and made available to major projects within and beyond the Department to allow bottom-up cost models to be developed against which both bids and outturn performance can be measured. There should be no tolerance for arguments that these data should not be shared by delivery organisations. There are initiatives underway in some Departments to collect and analyse comparator information on cost and time. This work needs to be accelerated and the expectation set that investment approval will need to see evidence of its effective use. International or cross-sector comparators can be used on a top-down basis to complement this analysis by providing a common-sense measure of total cost per unit (for example total construction cost per km of road or rail). In addition to better planning of future projects, comparator analysis can be used to identify best practice and inefficiencies allowing costs to be benchmarked and challenged.
Theme	**Control schedule and benefits as well as costs**

Source of lesson	Timetabling	Crossrail	GWE	Highways	Other
		✔	✔	✔	✔

C3.1 Protect the test phase diligently

Lesson

C3.1 Design stage | Construction stage | Commissioning stage | Operations stage

Make a conservative provision for the duration of the test phase as issues that emerge can require a wide range of fix times. Undertake progressive testing where possible to avoid late emerging defects. Resist the tendency to compress the test phase against a fixed in-service date when preceding phases are delayed and instead review the in-service date.

Explanation

The impact of delays to planned entry-into-service dates on the users, dependent projects, and the wider portfolio increases the closer delays occur to the planned date. There is a wider range of potential schedule impacts if testing fails to make the planned progress.

Some test issues can be resolved with a predictable amount of additional time, whereas others are inherently unpredictable and may take a disproportionate time to resolve. Late stage construction and testing can conflict with each other in managing access to test infrastructure. It is therefore important to make a conservative provision for the duration of the test phase.

It is critical to protect the duration of the test phase rigorously as it is often squeezed against the planned in-service date by delays earlier in the lifecycle. This may be rationalised by decision makers on the basis that there will be no testing if earlier delivery does not occur, on the optimistic assumption that everything will go well.

The test phase is not a substitute for schedule contingency and its duration should be protected. Project leaders should seek independent assurance of the planned duration of the test phase and should put in place controls requiring a reset if the in-service date cannot be met without compressing the test phase duration.

Theme

Deal with systems integration

Source of lesson	Timetabling	Crossrail	GWE	Highways	Other
	✔	✔			✔

C3.2 Invest in preparing contingency plans for the most significant risks

Lesson	**C3.2** Design stage · Construction stage · Commissioning stage · Operations stage Prepare in advance explicit and documented contingency plans for the more significant adverse events that could arise and review these for each phase. They should include the safest alternate plan if a "no-go" decision is taken at the point of commissioning and it becomes necessary to minimise impact on both the project and on wider operational services.
Explanation	Contingency plans require significant work to develop and maintain but allow controlled and rapid responses should high impact issues arise. Developing contingency plans in advance for the most significant risks for each lifecycle stage is a demanding discipline but can avoid poor decision making in crisis situations when significant resources will be managing the issues and may not be available to step back and consider the best revised strategy and plan. In the design stage contingency plans may include responding to legal challenges in procurements or revised political direction. In the construction stage they may include dealing with emerging delays or adverse cost trends. Contingency plans are especially important for the commissioning phase where Departments should ensure that the accountable organisation has identified the safest alternative if a no-go decision is taken at the point of beginning to commission the new capability. This will need to encompass protection of the existing service and its users, remedial action to complete making ready the new capability, and public handling of the causes and estimated remediation times and costs. In some cases it may be beneficial to seek agreement in advance to the automatic execution of agreed contingency plans should certain circumstances arise.
Theme	**Behaviour matters more than process**

Source of lesson	Timetabling	Crossrail	GWE	Highways	Other
	✔	✔			

C4.1 Identify, capture, share and apply lessons

Lesson	**C4.1** Design stage · Construction stage · Commissioning stage · Operations stage Ensure lessons identified in other major projects are reviewed at the design stage and ahead of each stage transition to ensure strategies and approaches that actively address the principal recurring issues. Make sure the principal project successes and failures are captured soon after they occur so that they are available for other project leaders to consider.
Explanation	While projects often differ there will most likely be shared elements where learning from others can be of huge benefit. By looking at what has happened before through a critical eye Departments can avoid the mistakes, and build on the successes of others. There is a risk that new major project leaders sometimes view their circumstances as unique and seek to develop strategies from first principles. Ideally major project leaders will instead review the lessons identified by others, extract the learning where it is applicable or transferable, and use this as a starting point from which they can innovate where better approaches are evident or their circumstances are truly unique. This is critical during all the project stages as new categories of risk will emerge requiring new strategies and capabilities to address them. The rote application of procedures or lessons or approaches from one major project to another can be equally dangerous if the circumstances are different or leaders assume that this eliminates the possibility of entirely new sorts of issues arising. Rather, the lessons from other projects need to be applied with judgement and with an active expectation that new types of problem may well arise. Lessons, whether from successes or failures, should also be captured and shared with other major projects as soon as possible after they are identified and major projects should dedicate resources to this function. At the same time Departments need to make these lessons readily available to their own major projects (including the sponsor, shareholder and delivery organisation's board and executive) and to other government departments where they are conceivably transferable. Lessons management activities should be planned and given sufficient time to be effective. Too often lessons management is only done at the very end of a project, which greatly reduces the value. Lessons should be demanded by project governance bodies, activities should be supported by formal and informal processes, and leaders should champion a culture of sharing and iterative learning.
Theme	**Behaviour matters more than process**

Source of lesson	Timetabling	Crossrail	GWE	Highways	Other
	✔	✔	✔	✔	✔

C4.2 Increase focus on managing schedule

Lesson	**C4.2** Design stage · Construction stage · Commissioning stage · Operations stage Control schedule risk with the same discipline as cost risk. Consider controlling primary milestones and some schedule contingency at the Departmental level. Ensure reporting provides confidence indicators against the primary milestones and against the remaining contingency. Communicate schedule risks to dependent projects early and automatically.
Explanation	Discipline in controlling schedule risk is weaker than in controlling cost risk despite schedule being a major driver of cost. Consequent delays lead to unplanned cost increases, public embarrassment if targets are prominent, and impacts on other dependent projects or operational services. Money can be wasted seeking to accelerate delivery against unachievable targets that subsequently have to be abandoned. Departments should consider controlling project milestones in a hierarchy. In this the delivery organisation will have greater delegation to change subordinate milestones than primary milestones. Similarly, Departments should consider how much schedule contingency is retained and how much is delegated and to which milestones it should be allocated. Control of primary milestones and retention of schedule contingency allows slippage to be detected earlier but reduces the ability of the delivery organisation to optimise its own plans and potentially recover slippage. Progress reporting against schedule should employ standardised confidence indicators to reduce the risk of misinterpretation caused by vague descriptive phrases such as “challenging but achievable”, “broadly on track”, or “potentially recoverable”. Confidence should be reported both against the target date and the date adjusted for contingency. Confidence indicators remain inherently subjective as they are based on judgement but standardisation increases the likelihood of a common interpretation. The focus should however be on the conversations around the confidence indicators (see B4.1). Delays, or risks of delays, from one project should be communicated immediately to other dependent projects, directly or via the portfolio function (see D3.1), to allow them to assess the impact which should be shielded if possible by float between the major project dependencies. The risks of setting uninformed in-service dates is covered in lesson A4.1.
Theme	**Control schedule and benefits as well as costs**

Source of lesson	**Timetabling**	**Crossrail**	**GWE**	**Highways**	**Other**
	✔	✔	✔	✔	✔

D3.1 Manage the whole portfolio to protect other projects and service users

Lesson

D3.1 Design stage | Construction stage | Commissioning stage | Operations stage

In tightly coupled systems manage all major projects as a single portfolio using a properly resourced and empowered portfolio office. Monitor the total amount of change planned, the risk of combined impacts on the operational service, and the consequential impacts of potential issues on end-users and dependent projects.

Explanation

Major projects are rarely delivered in isolation from other projects or existing services. Failure to manage the portfolio of major projects can lead to consequential impacts on other projects when one is delayed. It can also lead to unanticipated impacts on the existing system and its users if there are multiple issues from the attempted introduction of new capabilities that could have been absorbed in isolation, but cannot be managed when they occur in combination.

Portfolios need to be considered at the delivery organisation, Departmental level and, where considering industry-wide impacts, at the whole system level. Departments should ensure that their delivery bodies have a sufficiently capable, resourced and empowered portfolio function to address these risks locally, that they have their own capability at the corporate level, and that industry-wide structures are in place where appropriate.

In all cases the portfolio function needs to be able to see the status and scale of planned change across all major projects and to have sufficient authority and the mandate to challenge and, if necessary, alter plans and schedules. Major projects that are used to acting autonomously may be understandably resistant to compromises that are locally detrimental but necessary corporately.

An effective portfolio function can ensure the strategic alignment of major projects to ensure that they are not seeking the same benefits. It can sequence them to avoid driving wage inflation, skills shortages or boom and bust cycles in sectors where the government's buying power is dominant. The consequential impacts of delays in one project on others can be limited by introducing float between dependent major projects. Risks to existing services and their users can be mitigated by avoiding significant new capabilities entering service at the same time on highly utilised services or systems with low resilience.

Theme

Enter service cautiously

Source of lesson	Timetabling	Crossrail	GWE	Highways	Other
	✔	✔	✔	✔	✔

D3.2 Prepare to recover from disruption when new services are introduced

Lesson	**D3.2** Design stage · Construction stage · Commissioning stage · Operations stage Recognise that the introduction of a major new capability may have initial operational issues however good the planning and testing. Plan for the worst internally and communicate on the basis that disruption may occur, including with end-users, and prepare resilient recovery plans.
Explanation	The risk of impacts on current services from the introduction of new capabilities delivered by major projects cannot be eliminated entirely despite good portfolio planning, thorough testing, and controlled entry into service procedures including phased introduction to service. Departments should ensure that plans are in place for the worst case of significant disruption even if this is unlikely so that, should it occur, live services can be recovered to a stable state or their previous state as quickly as possible. Departments should ensure clear accountability for which organisation will take overall control of the incident and that organisation should be empowered to direct the actions of other organisations to enable effective recovery. The entry into service procedure and recovery plans should be exercised ahead of the actual commissioning event. The plans for entry into service should include communication with end-users explaining the potential risks, overall benefits and staged recovery plans should issues occur, so that they have realistic expectations.
Theme	**Enter service cautiously**

Source of lesson	Timetabling	Crossrail	GWE	Highways	Other
	✔	✔			✔

Appendices

Appendix A: Principal case studies

Crossrail

(Jointly sponsored by DfT and Transport for London, and delivered by Crossrail Limited)

Following a broadly successful construction stage, Crossrail Ltd announced unexpected and substantial delays and cost increases in summer 2018 shortly before the planned in-service date in December 2018. These issues arose from system integration challenges between rolling stock and signalling and in stations, as well as delays in station construction.

May 2018 timetabling for Northern and Thameslink/Great Northern services

(Overseen by DfT and the Office of Road and Rail, and delivered by Network Rail, Arriva UK Trains and Govia Thameslink Railway)

For Thameslink/Great Northern services, route training for drivers and train crew rosters was not completed at the time resulting in inefficient working patterns and cancellations. One of the causal factors was the finalisation of a decision to reduce the scale of the planned May 2018 changes which was confirmed in October 2017. This required an extensive amount of work adjusting and re-planning the timetable. This revised timetable was not finally resolved and agreed until 16 March 2018, nine weeks before the start of the Timetable.

Great Western Electrification

(Sponsored by DfT and delivered by Network Rail)

This project evolved from a limited upgrade into a large programme and then experienced significant cost increases and delays due to construction challenges and integration failures between rolling stock delivery and track availability.

Highways Complex Infrastructure Programme

(Sponsored by DfT and delivered by Highways England)

This includes the Lower Thames Crossing and A303 schemes at the planning stage and the A14 Improvement Scheme which is close to completion and on target. They have been reviewed to provide comparators with the rail projects in terms of their characteristics and their governance and control arrangements.

Appendix B: Interviewees and reviewers

Name	Organisation	Role
Jill Adam	DfT	Director, Strategic Roads, Economics and Statistics
Kirsty Austin	DfT	Head of Shareholding for HS2 Ltd and London and Continental Railways
Brendan Barratt	IPA	Review Team
Elizabeth Boardman	DfT	Review Team
Andrew Brunning	DfT	Delivery Manager
Brian Etheridge	DfT	Former Director of Network Services
Stephen Fidler	DfT	Head of Client Team, Roads, Devolution and Motoring Group
Lucy Findlay	Crossrail Ltd	Chief of Staff
Paul Fishwick	DfT	Project Director of Network Services North and Stations
Terri Harrington	Highways England	Sponsorship Director – Complex Infrastructure Programme
Paul Illingworth	IPA	Review Team
Robert Jennings	Crossrail Ltd	Non-Executive Director
Neil Kirkwood	Network Rail	HS2 Integration Director, System Operator
Lizzie Kumaria	DfT	Knowledge Manager for Rail Group

Name	Organisation	Role
Duncan Law	Network Rail	Principal Programme Sponsor for North West England
Matthew Lodge	DfT	Director of Major Rail Projects/ Director Rail Infrastructure South
Mark Livock	DfT	Principal Programme Client for Network Services North
Sofia Marcal-Whittles	DfT	Deputy Director of Rail Portfolio Office
Helen McGill	DfT	Deputy Programme Director, Intercity Express Programme
Alan Moore	IPA	Review Team Leader of high risk projects (including Crossrail)
Alan Over	DfT	Review Team
John Reed	DfT	Previously Programme Director for railway enhancements to the East Coast Main Line, East and West Midlands region, Chiltern and Freight.
Chris Sexton	Crossrail Ltd	Deputy Chief Executive Officer
Elliot Shaw	Highways England	Director of Strategy and Planning
Farah Sheik	DfT	Deputy Director of Network Services West
Chris Taylor	Highways England	Director of Complex Infrastructure Programme
Charles Upham	DfT	Project Sponsor, Intercity Express Programme
Kate Waters	IPA	Review Team
Peter Wilkinson	DfT	Director of Passenger Services

Appendix C: Definitions

These definitions aim to use commonly understood terminology but are not aligned fully with IPA standard terms.

Category	Term	Definition for the purposes of this report
Project terminology		
	Project	A unique, transient endeavour undertaken to achieve planned objectives. A major project is defined as one which is part of the Government Major Projects Portfolio normally based on its total cost. In practice major projects are often conducted as programmes.
	Programme	A group of related projects and change management activities that together achieve beneficial change for an organisation. Programmes are generally referred to as projects within the report to avoid repetition.
	Portfolio	A grouping of an organisation's projects, programmes and existing systems at the Departmental or delivery organisation level.
	Existing system	The capabilities already in service to which the project or programme aims to add.
	Lifecycle stage	Divisions in time of a project or programme where the mode of operation is distinct. In practice successive stages may overlap rather than be strictly sequential.
	Project leaders	Collective term for those leading the project across the sponsor, delivery organisation and supply chain including the Senior Responsible Owner, Chair and Chief Executive of the delivery organisation Board.

Category	Term	Definition for the purposes of this report
Entities		
	Department	A Department of State or Ministry within the UK's central government.
	Delivery organisation	The organisation tasked by the Department to deliver the major project. Often an arm's-length body (ALB) of the Department which is wholly owned by the Department but has varying degrees of separation and autonomy from it.
Roles performed by the entities		
	Sponsor (sometimes "Customer")	The function within a Department that designs and owns the major project and commissions the delivery organisation.
	Shareholder	The function within a Department responsible for creating and undertaking corporate governance of ALBs as opposed to project direction provided by the Sponsor team.
	Client	Normally the ALB's role in contracting a supply chain to deliver the Sponsor's requirements (see IPA Routemap). (Sometimes Departments may describe themselves as the client for non-major project work undertaken directly or by ALBs.)
	Supply chain	The private sector companies contracted by the delivery organisation to build the capability.
	End-user (sometimes "Customers")	The people who are intended to receive the benefits or operate the outputs of the major project.

Category	Term	Definition for the purposes of this report
Project lifecycle stages		
	Design	The period of a project from initiation to investment approval.
	Construction	The period during which the infrastructure or assets are built by the supply chain including subsystem testing.
	Commissioning	Final integration testing of the total system, preparation and entry-into-service where the outputs of the major project join the wider existing system.
	Operations	Use of the major project outputs as part of the enhanced existing system to deliver operational services to end-users.
Governance pillars (from IPA Routemap)		
	Accountability	Defines accountability for meeting the project's objectives and allocating the risk to those objectives.
	Authority	Provides for effective decision-making and assigns authority to make decisions and commitments.
	Alignment	Maintains alignment between corporate strategy/ objectives and those of the project or programme.
	Disclosure	Defines the disclosure of information required to assure stakeholders that the project is set to meet its objectives, or inform corrective action if not.

Category	Term	Definition for the purposes of this report
Integration definitions		
	Strategic integration	Aligning different systems to provide a coherent and optimised overall capability or outcome at the portfolio level. (In the case of rail, the single rail network in the UK consisting of existing systems that are being renewed, enhanced or augmented with new infrastructure or rolling stock.)
	Systems integration	Bringing together the component subsystems into an overall system that functions as intended. (In the case of rail the infrastructure, rolling stock, rail systems and operations.)
	Subsystem integration	Assembling the subsystem components so they function as intended in themselves. (An example for rail being signalling or the rolling stock.)

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